Docket No. ASP0031USCIP1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Henry K. Hui et al.	Confirmation No.:		7463
Appln. No.	:	10/016,057	Art Unit	:	1744
Filed	:	November 2, 2001	Examiner	:	K.M. Jastrzab

Title : APPARATUS AND METHOD FOR MONITORING OF OXIDATIVE GAS OR VAPOR

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Angelina Petti
(Name of applicant, assignee, or Registered Representative)

/Angelina Petti/
(Signature)

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(Date of Signature)

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

I. Real Party in Interest

The present application is assigned to Ethicon, Inc., a wholly owned subsidiary of Johnson & Johnson, via an assignment recorded at Reel 012392, Frame 0779.

II. Related Appeals and Interferences

There are no related appeals or interferences.

III. Status of the Claims

The case contains 29 claims, each of which are pending in the application. All of the claims, with the exception of claims 8 and 24, stand rejected and form the basis for this appeal.

IV. Status of Amendments

No amendments have been filed after the issuance of the Final Office Action.

V. Summary of the Claimed Subject Matter

Claim 1 defines an apparatus 10 which provides for monitoring the concentration of an oxidative gas or vapor. The apparatus comprises a first thermocouple junction 110 having a chemical substance 14 coupled thereto. The chemical substance is reactive with the oxidative gas or vapor to produce heat. A second thermocouple junction 112 couples in series to the first thermocouple junction. A net voltage is generated across the first and second thermocouple junctions upon exposure of the chemical substance to the oxidative gas or vapor, the net voltage corresponding to the concentration of the oxidative gas or vapor. (Spec. page 5, lines 2 to 9 and page 18, line 10 to page 19, line 25; Figure 3B)

Claim 18 defines a method for monitoring the concentration of an oxidative gas or vapor. The method comprises providing a first thermocouple junction 110 and a second thermocouple junction 112 coupled together in series. The first thermocouple junction is coupled to a chemical substance 14 which undergoes an exothermic reaction with the oxidative gas or vapor to be monitored. The method includes the steps of exposing the chemical substance to the oxidative gas or vapor, thereby generating a net voltage across the first and second thermocouple junctions, the net voltage being a function of the concentration of the oxidative gas or vapor, and measuring the net voltage across the first and second thermocouple junctions as an indication of the concentration of the oxidative gas or vapor. (Spec. page 5, lines 10 to 19 and page 18, line 10 to page 19, line 25; Figure 3B)

VI. Grounds of Rejection to be Reviewed on Appeal

A. The rejection of claims 1 to 7, 9, 10, 18 to 23 and 25 under 35 U.S.C. §102(b) over Krahe (GB 2,191,585).

B. The rejection of claims 1 to 3, 9, 10, 18, 19 and 25 under 35 U.S.C. §102(b) over Foller (WO 91/05998).

C. The rejection of claims 11 to 17 and 26 to 29 under 35 U.S.C. §103(a) over either Foller or Krahe, in view of the Pai et al. US Patent No. 6,156,267.

VII. Arguments

A. The rejection of claims 1 to 7, 9, 10, 18 to 23 and 25 under 35 U.S.C. §102(b) over Krahe (GB 2,191,585).

Claim 1 defines a net voltage generated across the first and second thermocouple junctions upon exposure of the chemical substance to the oxidative gas or vapor, the net voltage corresponding to the concentration of the oxidative gas or vapor. Claim 18 defines the step of measuring the net voltage across the first and second thermocouple junctions as an

indication of the concentration of the oxidative gas or vapor. Each of the other claims depends from one of these two claims. Krahe does not teach the generating and measuring a net voltage to determine a concentration of an oxidative vapor. As is shown by figure 2, each temperature sensor is independently tied back to the controller. Accordingly, Krahe fails to anticipate the claimed invention.

Claims 3 and 19

Claims 3 and 19 define that the net voltage across the first and second thermocouple junctions is zero when the chemical substance is not exposed to the oxidative gas or vapor. Krahe fails to disclose generating a net voltage, and fails to show a zero net voltage when the chemical substance is not exposed to the oxidative vapor. Accordingly, Krahe fails to anticipate either claim 3 or 19.

Claims 9, 10 and 25

Claims 9 and 25 define a carrier which couples the chemical to the thermocouple and claim 10 defines a heat conductor between the chemical and the thermocouple. Krahe lacks such teaching.

B. The rejection of claims 1 to 3, 9, 10, 18, 19 and 25 under 35 U.S.C. §102(b) over Foller (WO 91/05998).

Claim 1 defines a net voltage generated across the first and second thermocouple junctions upon exposure of the chemical substance to the oxidative gas or vapor, the net voltage corresponding to the concentration of the oxidative gas or vapor. Claim 18 defines the step of measuring the net voltage across the first and second thermocouple junctions as an indication of the concentration of the oxidative gas or vapor. Each of the other claims depends from one of these two claims. Foller does not teach the generating and measuring a net voltage to determine a concentration of an oxidative vapor. As is shown by figure 1, each temperature sensor is independently tied back to the controller. Accordingly, Foller fails to anticipate the claimed invention.

Claims 3 and 19

Claims 3 and 19 define that the net voltage across the first and second thermocouple junctions is zero when the chemical substance is not exposed to the oxidative gas or vapor. Foller fails to disclose generating a net voltage, and fails to show a zero net voltage when the chemical substance is not exposed to the oxidative vapor. Accordingly, Foller fails to anticipate either claim 3 or 19.

Claim 21

Claim 21 defines the chemical substance as being chemically reactive with hydrogen peroxide. Foller is concerned with ozone and specifically picks materials non-interactive with other chemicals. Foller fails to anticipate claim 21.

Claim 22

Claim 22 defines the chemical substance as a material that catalytically decomposes hydrogen peroxide. Foller is concerned with ozone and specifically picks materials non-interactive with other chemicals. Foller fails to anticipate claim 22.

Claim 23

Claim 23 defines the chemical substance as a material that is oxidized by hydrogen peroxide. Foller is concerned with ozone and specifically picks materials non-interactive with other chemicals. Foller fails to anticipate claim 21.

C. The rejection of claims 11 to 17 and 26 to 29 under 35 U.S.C. §103(a) over either Foller or Krahe, in view of the Pai et al. US Patent No. 6,156,267.

Adding Pai et al. to either Foller or Krahe fails to solve the problem that none of these three references teach the limitation of measuring a net voltage between the two thermocouples, one having the chemical substance and one lacking it, rather than measuring them separately. Using the method claimed by Applicants reduces complexity, and further enhances accuracy. Zeroing the probe is easily accomplished by testing it with no oxidative atmosphere and ensuring a net zero voltage. The Examiner points to the entry on thermocouples in Von Nostrand's Scientific Encyclopedia as evidence that the method and device claimed by Applicants is standard thermocouple construction. A thermocouple is not the provision of a first

and a second junction connected serially, as argued by the Examiner. As explained in Von Nostrand, a thermocouple is a junction of two dissimilar metals and with one junction of the two dissimilar metals you make one thermocouple. Applicants claim two thermocouples, and specifically two thermocouples wherein a relative temperature differential between the two is found by measuring the voltage difference between the two rather than measuring a first temperature and a second temperature and then calculating the difference. The references, either singly, or in combination, fail to reach the claimed invention.

Claim 26

Claim 26 defines a carrier coupling the chemical substance to the thermocouple, the carrier comprising a gas-permeable pouch or gas-impermeable enclosure with at least one hole. None of the reference teach using a gas permeable pouch to attach the chemical to the thermocouple.

Conclusion

Applicants submit that the Examiner has failed to establish a prima facie case of obviousness or anticipation. Accordingly, Applicants request reversal of the rejections and allowance of the case.

Respectfully submitted,

By: /Andrew C. Farmer/
Andrew C. Farmer
Reg. No. 35,868
Attorney for Applicant(s)

Johnson & Johnson
One Johnson & Johnson Plaza
New Brunswick, NJ 08933-7003
(732) 524-2825
Dated: July 9, 2007

CLAIMS APPENDIX

1. An apparatus for monitoring the concentration of an oxidative gas or vapor, the apparatus comprising:

a first thermocouple junction;

a chemical substance coupled to the first thermocouple junction, the chemical substance reactive with the oxidative gas or vapor to produce heat; and

a second thermocouple junction coupled in series to the first thermocouple junction, whereby a net voltage is generated across the first and second thermocouple junctions upon exposure of the chemical substance to the oxidative gas or vapor, the net voltage corresponding to the concentration of the oxidative gas or vapor.

2. The apparatus as defined in Claim 1, wherein the second thermocouple junction is substantially similar to the first thermocouple junction.

3. The apparatus as defined in Claim 2, wherein the net voltage across the first and second thermocouple junctions is zero when the chemical substance is not exposed to the oxidative gas or vapor.

4. The apparatus as defined in Claim 1, wherein the oxidative gas or vapor comprises hydrogen peroxide.

5. The apparatus as defined in Claim 1, wherein the chemical substance is a material that chemically reacts with hydrogen peroxide.

6. The apparatus as defined in Claim 1, wherein the chemical substance is a material that catalytically decomposes hydrogen peroxide.

7. The apparatus as defined in Claim 1, wherein the chemical substance is a material that is oxidized by hydrogen peroxide.

8. The apparatus as defined in Claim 1, wherein the chemical substance comprises hydroxyl functional groups.

9. The apparatus as defined in Claim 1, wherein the apparatus further comprises a carrier which couples the chemical substance to the first thermocouple junction.

10. The apparatus as defined in Claim 1, wherein the apparatus further comprising a heat conductor between the chemical substance and the first thermocouple junction.

11. The apparatus as defined in Claim 1, wherein the apparatus further comprises a connector to connect and disconnect a first portion of the apparatus coupled to the chemical substance to a remaining portion of the apparatus.

12. The apparatus as defined in Claim 1, wherein the apparatus is positionable at one or more locations, whereby the net voltage is a function of the concentration of the oxidative gas or vapor at the location.

13. The apparatus as defined in Claim 1, wherein the second thermocouple junction is in a diffusion-restricted region with the first thermocouple junction.

14. The apparatus as defined in Claim 1, wherein the apparatus further comprises an integrated circuit chip which comprises the first thermocouple junction and second thermocouple junction.

15. The apparatus as defined in Claim 1, wherein the first thermocouple junction comprises a first conductor and a second conductor coupled to the first conductor, the second conductor being different from the first conductor, and the second thermocouple junction comprises the second conductor coupled to a third conductor.

16. The apparatus as defined in Claim 15, wherein the third conductor is composed of the same material as the first conductor.

17. The apparatus of Claim 15, wherein at least one of the first conductor, second conductor, and third conductor comprises a conductive film.

18. A method of monitoring the concentration of an oxidative gas or vapor, the method comprising:

providing a first thermocouple junction and a second thermocouple junction coupled together in series, the first thermocouple junction coupled to a chemical substance which undergoes an exothermic reaction with the oxidative gas or vapor to be monitored;

exposing the chemical substance to the oxidative gas or vapor, thereby generating a net voltage across the first and second thermocouple junctions, whereby the net voltage is a function of the concentration of the oxidative gas or vapor;

measuring the net voltage across the first and second thermocouple junctions as an indication of the concentration of the oxidative gas or vapor.

19. The method as defined in Claim 18, wherein the net voltage across the first and second thermocouple junctions is zero when the chemical substance is not exposed to the oxidative gas or vapor.

20. The method as defined in Claim 18, wherein the oxidative gas or vapor comprises hydrogen peroxide.

21. The method as defined in Claim 18, wherein the chemical substance is a material that chemically reacts with hydrogen peroxide.

22. The method as defined in Claim 18, wherein the chemical substance is a material that catalytically decomposes hydrogen peroxide.

23. The method as defined in Claim 18, wherein the chemical substance is a material that is oxidized by hydrogen peroxide.

24. The method as defined in Claim 18, wherein the chemical substance comprises hydroxyl functional groups.

25. The method as defined in Claim 18, wherein the chemical substance is coupled to the first thermocouple junction by a carrier.

26. The method as defined in Claim 25, wherein the carrier comprises a gas-permeable pouch or gas-impermeable enclosure with at least one hole.

27. The method as defined in Claim 18, additionally comprising moving the apparatus to one or more locations, whereby the net voltage is a function of the concentration of the oxidative gas or vapor at the location.

28. A sterilization system operated by a user, wherein the sterilization system comprises:

a chamber;

a door in the chamber;

a source of oxidative gas or vapor in fluid connection with the chamber;

a chemical concentration measuring system comprising at least one apparatus according to Claim 1; and

a control system which receives input from the chemical concentration measuring system to produce a desired concentration of said oxidative gas or vapor.

29. The system as defined in Claim 28, wherein the system further comprises a pumping system to reduce the pressure in the chamber.

EVIDENCE APPENDIX

1. Van Nostrands Scientific Encylopedia, Sixth Edition, pages 2800 and 2801

RELATED APPEALS AND INTERFERENCES APPENDIX

[NONE]

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA

Sixth Edition

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DOUGLAS M. CONSIDINE, P.E.
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GLENN D. CONSIDINE
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COMMONLY USED THERMOCOUPLES AND TEMPERATURE RANGES

ANSI Type	Positive Element	Negative Element	Normal Temperature Range °F	Normal Temperature Range °C
B	Platinum 20% Rhodium	Platinum 6% Rhodium	1,600–3,100	870–1,700
E	Chromel	Constantan	32–1,600	0–870
J	Iron	Constantan	32–1,400	0–760
K	Chromel	Alumel	32–2,300	0–1,260
R	Platinum 13% Rhodium	Platinum	32–2,700	0–1,480
S	Platinum 10% Rhodium	Platinum	32–2,700	0–1,480
T	Copper	Constantan	−300–+700	−180–+370

of a thermocouple may be joined by any means that will ensure good electrical continuity when in use. Commonly, the two wires are twisted together and either welded or silver-soldered. Simple clamping of wires together provides adequate connection for short-term use in clean atmospheres at lower temperatures. For industrial applications, the thermocouple is usually placed within a protecting tube. A typical

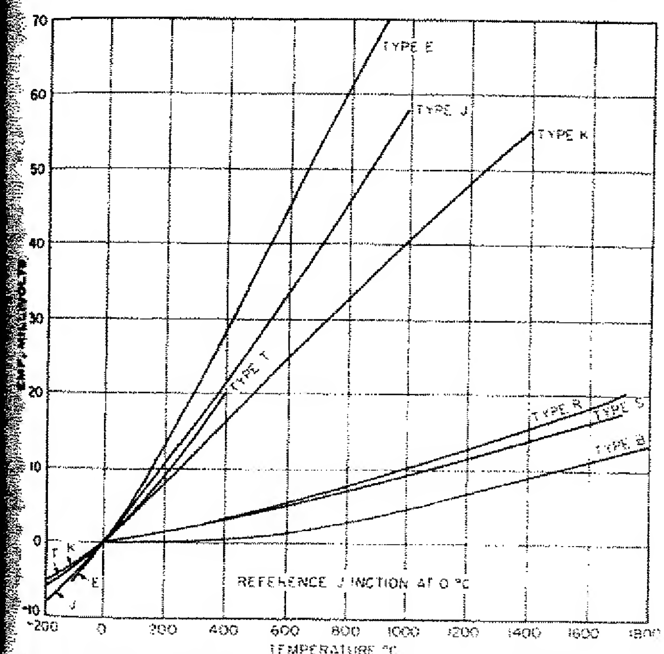

Fig. 3. Temperature-thermal emf curves for common types of thermocouples. (*Honeywell.*)

assembly is shown in Fig. 4. For lower temperatures, carbon steel may be used. As the temperature goes up, wrought iron, stainless steel, nickel, nickel-chromium-iron, fused silica, silica-alumina, silicon carbide, alumina, and beryllia may be used. Beryllia protecting tubes will withstand operating temperatures of up to 4,000°F (~2,200°C). For some applications, disposable-tip thermocouples have been developed. These are particularly effective for high-temperature molten-metal temperature measurements.

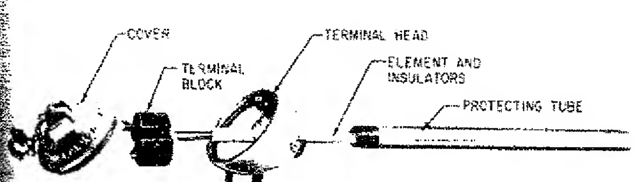

Fig. 4. Assembly of industrial thermocouple, terminal block, and protecting tube. (*Honeywell.*)

The emf developed by a thermocouple depends upon the temperature of both the measuring and reference junctions. Thus, to determine temperature, the following data must be known: (1) the calibration data for the particular thermocouple; (2) the measured emf; and (3) the temperature of the reference junction. In laboratory cases, the reference junction can be maintained at the freezing temperature of water. However, in most modern instruments, the ambient temperature of the reference junction is sensed, and the correction is incorporated in the measurement circuitry.

Multiple thermocouples may be used in parallel and connected to a single instrument. A typical application is a fire-warning system. Multiple thermocouples also may be connected in series. This is a means for obtaining the average temperature of an object. Also two or more thermocouples may be connected in series so that the emf outputs of the couples are additive. In application installations, thermopiles sometimes are used to detect the presence or absence of the pilot flame and cause a relay to turn off the main gas supply valve. A common use of the thermopile is in thermal-radiation pyrometers where it is desired to obtain a larger emf than would be possible from a single thermocouple. A thermopile developed for this purpose is shown in Fig. 5.

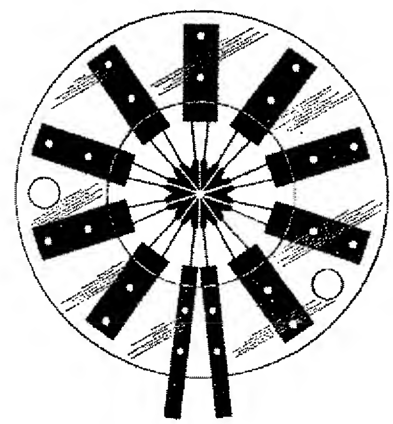

Fig. 5. Thermopile used in radiation pyrometer. Hot junctions are in center. Reference-junction temperatures are at the connection tabs. Actual device is less than 1 inch (2.5 centimeters) in diameter. (*Honeywell.*)

References

Magison, E. C.: "Thermocouples," in "Process Instruments and Controls Handbook," 2nd edition (D. M. Considine, editor), McGraw-Hill, New York, 1974.

Staff: "Temperature Measurement—American National Standard (MC96.1) for Temperature Measurement Thermocouples," Instrument Society of America, Research Triangle Park, North Carolina, 1980.

Staff: "Temperature—Its Measurement and Control in Science and Industry," Vol. 4, Part 3, Instrument Society of America, Research Triangle Park, North Carolina, 1972.

THERMODYNAMIC EQUILIBRIUM. Equilibrium.

THERMODYNAMIC FLUCTUATIONS. Fluctuations (System).

THERMODYNAMICS. Classical thermodynamics is a theory which on the basis of four main laws and some ancillary assumptions deals with general limitations exhibited by the behavior of macroscopic systems. Phenomenologically it takes no cognizance of the atomic constitution of matter. All *mechanical* concepts sush as kinetic energy or work are presupposed. Thermodynamics is motivated by the existence of dissipative mechanical systems. A *thermodynamic system K* may be thought of as a collection of bodies in bulk; when its condition is found to be unchanging in time (on a reasonable time scale) it is *in equilibrium*. It is then characterized by the values of a finite set of say *n* physical quantities, it being supposed that none of these is redundant. Such a set of quantities constitutes the *coordinates* of *K*,

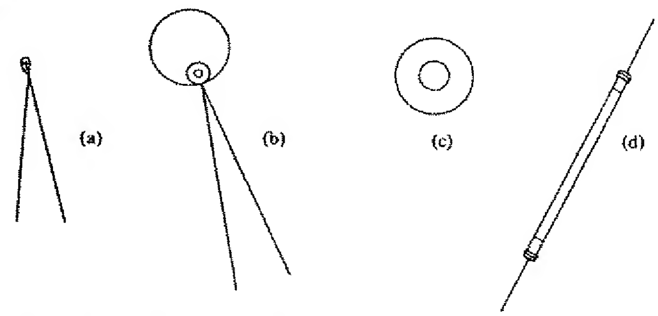

Fig. 1. Thermistor configurations: (a) bead, (b) disk, (c) washer, (d) rod.

Furthermore, it is apparent that the thermistor's resistance-temperature function has a characteristic high negative coefficient as well as a high degree of nonlinearity. The value of the coefficient for a common commercial thermistor is on the order of 2–6% per °K at room temperature. This value is approximately ten times that of metals used in the manufacture of resistance thermometers.

Resultant considerations due to the high coefficient characteristic of thermistors include inherent high sensitivity and high level of output, eliminating the need for extremely sensitive readout devices and leadwire matching techniques. However, limitations on interchangeability (particularly over wide temperature ranges), calibration, and stability—also inherent to thermistors—are quite restrictive. The high degree of nonlinearity in the resistance-temperature function usually limits the range of the readout instrumentation. In many applications, special prelinearization circuits must be used before interfacing with related system instrumentation. The negative temperature coefficient also may require an inversion (to positive form) when interfacing with some analog and/or digital instrumentation.

A number of metal oxides and their mixtures, including the oxides of cobalt, copper, iron, magnesium, manganese, nickel, tin, titanium, uranium, and zinc are among the most common semiconducting materials used in the construction of thermistors. Usually compressed into the desired shape from specially formulated powder, the oxides are then recrystallized by heat treatment, resulting in a dense ceramic body. The leadwires are then attached while electric contact is maintained, and the finished thermistor is then encapsulated. Some common configurations of thermistors are shown in Fig. 1. A comparison of the resistance-temperature characteristics of thermistors with platinum metal used in resistance thermometers is given in Fig. 2.

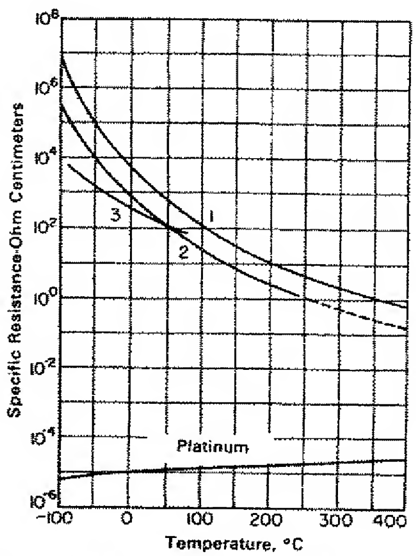

Fig. 2. Resistance-temperature characteristics of thermistors as compared with platinum metal used in resistance thermometers.

THERMOCHEMICAL SPLITTING (Water). Hydrogen (Fuel).

THERMOCHEMICAL SYSTEMS (Solar). Solar Energy.

THERMOCHEMISTRY. That aspect of chemistry which deals with the heat changes which accompany chemical reactions and processes, the heat produced by them, and the influence of temperature and other thermal quantities upon them.

THERMOCLINE. That layer of water in the oceans situated between the relatively warm surface water and the much colder main mass of water at the bottom. The temperature falls rather sharply in this layer, or zone, in contrast to the others that are relatively uniform. See **Ocean**; and **Solar Energy**.

THERMOCOUPLE. In 1821, Seebeck discovered that an electric current flows in a continuous circuit of two metals if the two junctions are at different temperatures, as shown in Fig. 1. A and B are two

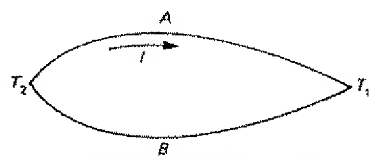

Fig. 1. Simple thermocouple circuit.

metals, T_1 and T_2 are the temperatures of the junctions. I is the thermoelectric current. A is thermoelectrically positive to B if T_1 is the colder junction. In 1834, Peltier found that current flowing across a junction of dissimilar metals causes heat to be absorbed or liberated. The direction of heat flow reverses if current flow is reversed. Rate of heat flow is proportional to current but depends upon both temperature and the materials at the junction. Heat transfer rate is given by PI, where P is the Peltier coefficient in watts per ampere, or the Peltier emf in volts. Many studies of the characteristics of thermocouples have led to the formulation of three fundamental laws:

1. *Law of the homogeneous circuit.* An electric current cannot be sustained in a circuit of a single homogeneous metal; however it may vary in section, by the application of heat alone.
2. *Law of intermediate metals.* If in any circuit of solid conductors the temperature is uniform from any point P through all the conducting matter to a point Q, the algebraic sum of the thermoelectromotive forces in the entire circuit is totally independent of this intermediate matter and is the same as if P and Q were put in contact.
3. *Law of successive or intermediate temperatures.* The thermal emf developed by any thermocouple of homogeneous metals with its junctions at any two temperatures T_1 and T_3 is the algebraic sum of the emf of the thermocouple with one junction at T_1 and the other at any other temperature T_2 and the emf of the same thermocouple with its junctions at T_2 and T_3. See Fig. 2.

Common thermocouple wire combinations used in industry are listed in the accompanying table. A choice of different metals is needed to fulfill a broad range of temperatures as well as for oxidizing or reducing conditions in use. The temperature-thermal emf curves for common types of thermocouples are given in Fig. 3. The hot junction

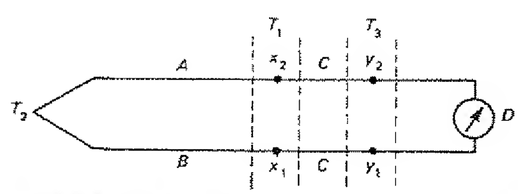

Fig. 2. Law of Intermediate Metals makes it possible to use "foreign" wires to connect thermocouple to measuring instrument. Thermocouple materials A and B can be connected to the instrument by use of connecting materials C and D. If the temperatures at X_1 and X_2 are both at T_1 and if temperatures at Y_1 and Y_2 are both at T_3, the emf of the circuit will be independent of materials C and D. (*Honeywell.*)